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By ✓

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STATIC ELECTRICITY AS A THERAPEUTIC AGENT.

This paper, in which I have the honor of reading before this intelligent audience, members of the Academy of Medicine, I have endeavored to present the subject matter in as comprehensive a manner as possible, having had experience in the use of static electricity for over fifty years, and availed myself of much reliable information upon this subject.

The source from whence static electricity is obtained upon the various devices, is of some importance, and from what authority the information is obtained, that is, the most noted persons for their knowledge in that branch of science, I will give a brief statement of the information they have given to the public. The diurnal rotation of the earth on its axis from west to east occasions in the equatorial regions constant and successive unequal heating and cooling of the surface in contrary directions from east to west currents of thermo-electricity, which are thereby established in the latter direction. These give rise to the magnetism of the earth and directive power of which is of necessity at right angles with the former (Prout).

The earth may therefore be viewed : *First*, as one large electrical machine, of which the direction of the current is from east to west ; and, *secondly*, as a vast magnet, of which the poles are beneath the surface, and of which the directive force is nearly parallel with its axis, or from north to south. Electricity of the atmosphere (and as termed static electricity), of which the atmosphere abounds, is derived from the thermo-electricity of the atmosphere. Electro-magnetism represented in the small electrical machines now in use is simply the reversing of the magnetic poles eliminating static electricity (Knight).

STATIC ELECTRICITY, from the universality of its action, doubtless plays an all-important part in the sustentation of health, the germination of plants, the production of ozone, rain, snow, hail and tempest. Dr. Prout is of the opinion that the source of static electricity is derived from a combination of water and oxygen, a compound analogous to dutoxide of hydrogen (ozone), which he supposes to be frequent, if not a constant ingredient in the atmosphere, and the cause of numerous atmospheric phenomena at present but little understood (Prout, Bridgewater Treatise, page

342, and appendix, page 569). In the *New Orleans Medical and Surgical Journal* of July, 1881, is an elaborate paper upon the influence of static electricity upon the human system, by Henry Stone, M. D.

STATIC ELECTRICITY increases in proportion as we ascend from the surface of the earth, and at a certain height becomes uniform and constant. Dry and pure air is one of the most complete non-conductors of static electricity, tending to a maximum quantity, and lessens in gradation to the increase of moisture, the earth being invariably in a minor condition.

The usual condition of static electricity is in a lower degree during the night, and its minimum at about 3 A. M.; it increases at sunrise, and diminishes about noon, increases again towards sunset, and becomes lessened during the night, being much affected by the winds (Brand).

Professor Quételet, Astronomer Royal of Belgium, states that atmospheric electricity is in the highest intensity during the month of January, and attains to its minimum in June. The distribution of atmospheric electricity diminishes from the equator to the poles.

In Norway it rarely thunders; in Iceland once only in two years; in Peru never (Kosmos).

Professor Glaisher, Meteorologist of London, states that the prevalence of epidemic or pestilential disease has been associated with the absence or deficiency to that of a maximum diffusion of atmospheric electricity; and the mortality has been found to be in the inverse ratio of the amount of electricity with which the air is charged. The contrary when the air is charged to a maximum condition throughout the day, the number of deaths decrease. And to this electrical condition or influence I have had ample experience to confirm what has been stated by this high authority, during the visitation of Asiatic cholera in this country.

After having applied static electricity to patients for various ailments, and affording much relief to more especially rheumatic affections. In the winter of 1834 a glass cutter applied to me for treatment of his paralyzed right wrist to the hand (now known as "dropped hand")—the member being powerless as to extending the hand—produced from exposure to cold water dropping upon his hand and the grindstone upon which he was cutting ornaments upon glass on a cold night in winter.

From a small cylindrical static electrical machine, and a six-ounce Leyden jar, having about one-half of the inner and outer surface covered with tin foil, I applied light shocks to the arm from

the shoulder to the extremity of the phalanges daily, for two weeks, the hand increasing in power all the time, and finally restored to a normal condition. After this I continued to use static electricity in cases of infantile paralyses and various other neuralgic derangements in the Baltimore General Dispensary for six years with most favorable results. After this I left the City of Baltimore, and located in the City of New York in December, 1835. After residing here for a few weeks, I learned of an electrician named Jonas Humbert, an adventurer and a man of intelligence, who was making extraordinary cures by the application of static electricity. I called on him, and entered into an agreement to attend at his office, mornings, to observe and assist in his labors for three months. To my great astonishment I observed most remarkable curative results from the application of static electricity in its various modifications. This man had large cylinder machines, and insulating platforms upon which he placed his patients, and from that time to this, when possible, I have applied static electricity, having availed myself of large and small plate electrical machines; but laboring under the influence of the unfavorable atmospheric conditions that deprived me of its use, I was compelled to resort to dynamic electricity in its varied forms, and in 1843 applied it to patients attending Professor Mott's clinics in the Stuyvesant rooms on Broadway, the operations being those of acupuncture more especially, and in my private practice, when static electricity failed to serve, made dynamic electricity available. Now, to my delight, the wonderful improvement made by the introduction of the "Holtz Electrical Machine," which I had the pleasure of observing some ten years since at the Polytechnic department of the American Institute. Although a rainy evening and the room filled with spectators, the machine eliminated sparks passing through a space of six inches from ball to ball. Ten years have passed since then, and only within a few months have I been enabled to obtain one of those very valuable machines, which I have in working order at the Hospital for the Relief of the Ruptured and Crippled, and so impressed with its favorable results, that I am disposed to dispense with all other devices of electrical production for therapeutic use in this hospital, in which I have the honor of control in the medical department.

Yet, dynamic electricity is worthy of most favorable consideration. My assistant, Dr. V. P. Gibney, has published, from our records, several extraordinary cases of sciatica cured by the primary current of dynamic electricity.

Static electricity is subject to many forms of application, differing from the dynamic, and, as I believe, more extensively useful as a therapeutic agent; producing two distinct influences upon the animal system, as an *excitant* and decided *sedative*. The dynamic is merely an excitant, as I have determined in my long experience; and not available in diminishing directly morbid nervous energy in muscles as the former, and only indirectly by restoring normal energy by effort, in time. In the operation of static electricity, when insulating patients, and producing a maximum diffusive quantity of static electricity, and then drawing it off with sharp metallic points connected with the earth, the influence is so great as to induce syncope in delicate persons, as I have frequently witnessed. The influence is only temporary, however, tending to a normal restoration of nervous influence and a reduction of local inflammation.

ELECTRIC SHOCK.—By means of the Leyden jar the most powerful concussion is given, even to the degree of destroying life. When the ball of this jar is put in contact with the prime conductor of the electrical machine, and electricity accumulated, the interior of the jar becomes plus or positively charged, the outer coat being minus or in an opposite condition. If, now, any part of the patient is made the medium of connection with a good conductor, as that of metallic cords and the hand conductors applied to the part to be operated upon, and the balls are in contact, no sensible effect will be produced, because the inner and outer metallic coating of the jar are thus in a state of equilibrium. The current being continuous, the outer coat of the jar being connected with the earth, the silent current is established; but if the balls are separated, the intervening space being comparatively dry atmospheric air—a partially non-conductor—the electricity accumulates in the interior of the jar, and in quantity to the extent of the metallic surface; so that, if a large jar, the quantity will at a certain degree of tension readily pass from one ball to the other in the form of a condensed spark, making a report and sudden concussion as it passes through the intervening space that separates the inner and outer coating of the jar, a joint of a patient being part of the circuit. The severity of the concussion or shock, as it is termed, is in ratio to the extent of the metallic surface in the jar, and the distance the balls may have been separated. Hence, the separation of the balls determines the severity of the shock of a given-sized Leyden jar, or a battery of many jars, even to the fusing of the metal cord through which it is conducted.

The shock being used as a curative means, can be definitely modified by having a lesser or greater surface of glass coated on both sides with tin foil, so insulated as not to be connected by two or more inches from the metallic surface on both sides, by which the intensity of the accumulation can be obtained that will give the shock required. A glass tube coated with tin foil two or three inches on the inner and outer side, and used in place of the Leyden jar, as in ordinary use, serves an admirable purpose for nearly all curative purposes where intensity is required with lessened severity. By this operation decided tetanization of muscles is induced, using, in place of one or both balls of the electrodes, disks of sponge moistened.

These several modifications of static electricity we consider as excitants, or sedative, and subject to diffusion or localization.

The various conditions of the application of static electricity are only preparatory to various modifying effects to be obtained in accordance with the desire and judgment of the practitioner; differing from that of dynamic electricity in its availability to the practitioner as a means of controlling the various morbid conditions of nervous energy, as that of *deficiency* or *excess*, without permanently injuring the normal conditions of tissues or organic functions. It is, apparently, congenial to organized matter, and in consonance with the atmosphere from which it is obtained, and which, when concentrated, decomposes the air, eliminating ozone, a well known desirable disinfectant, readily detected by the sense of smell; and is it not a neutralizer of morbid animal secretion? Static electricity is a powerful therapeutic agent, requiring not only a profound knowledge of the natural laws regarding it, but an equal knowledge of anatomy and physiology. If applied locally to the muscles, their origin and insertion must be known to the operator, and if made to act through the nerves, then their connection with the nervous centres, their course, anastomoses and termination, also, of the laws which regulate the electrical currents in the muscles and nerves, and the relation of these laws to the vital and physical forces. This applies equally to all the devices for generating electricity, and its application as a remedial therapeutic agent.

The recent discovery of laws that govern electricity as a therapeutic agent of determined influence upon the muscles and nerve tissues, and the relation of these laws to the vital and physical forces, establishes it within the circle of scientific

acceptation. Mattucci, Becquerel and Du Bois Reymond, Dr. Golding Bird, Professor Clemens, Sewanda, Charcot and Dr. Vigouroux, have discovered and promulgated the methods of their discovery, with which my experience coincides. These laws of electrical influence made by some of the most reliable and noted electricians, and applied to electrical diagnosis, tend to the most invaluable results in the practice of medicine.

VITALIZING POWER.—One of the most common objects of electrical application, is to co-operate with vitality. This, indeed, may be considered the central principle in the medical use of electricity. In the nervous system it is illustrated in cases of exhaustion, prostration, enervation and paralysis; in the tissues, in gangrene, erysipelas, in indolent ulcers and deficient nutrition. It will be found, indeed, to enter more or less directly into every case of the application of static electricity. The idea will be frequently suggested to the practitioner, by his own observation, that the agency of electricity works in the direction of health, even in the most opposite affections. This is admitted simply by the fact, that its operation is to quicken vital force and normal functions of the part to which it is applied. Diseased action, when local, is perhaps especially controlled by the supply of nervous force, mental and physical, as I have observed in my practical treatment of joint diseases in children, which is brought into action, connecting and harmonizing functions.

REACTIVE POWER.—Electricity constitutes, in the hands of the medical practitioner, a reactive power. According to Matteucci, the nervous system responds to electricity after all other stimulants have ceased to act.

ELECTRICAL INFLUENCE.

Alterative Action.

An influence frequently exerted by electricity is that of changing the action of an organ, or the general tone of the system, thereby arresting a diseased condition.

PROMOTION OF NUTRITION.

In deficient nutrition, electricity may co-operate in the vital transformation and organization of the nutrient matter, by means of the nervous system or by direct action on the tissues of a part. To produce increased action in the latter case, static or galvanic electricity may be used. This will be done wherever a part needs

to be nourished, or the waste of any organ to be replaced. As a general rule, the current should be feeble, and the application long continued and frequent. For this purpose static electricity is much more efficient than dynamic.

PROMOTION OF ABSORPTION.

In effusions of serum, or lymph, in some forms of hypertrophy, in bony deposits, rheumatic enlargements and every undue organic development, with the exception, perhaps, of some malignant growths, the power of the absorbents needs to be quickened, and this may often be effected by electrical action. In this case, the application is usually made directly to the organ, though the rule still prevails, in acting through the nervous system, that the vital stimulus artificially supplied directs itself to, or principally perceived in, that function whose efficiency is suspended. In other words, the tendency of the nervous influence seems to be, to harmonize the various vital functions, disproportionate action appearing thus to proceed from causes acting originally on the life of tissues. In serous effusions accompanied with inflammation, cautious and gentle application of static electricity will be effectual.

RESULTS OF STATIC ELECTRICITY.

This condition of the patient and the favorable results from the use of static electricity was of my earliest experience. Col. L. of Great Barrington, Mass., was most seriously afflicted, having synovitis affecting nearly every joint in his formation. The cause was exposure to a running stream of cold water for a considerable duration of time, in repairing a mill-dam in the month of April, 1836.

The first indication of the invasion, was an inability to rotate the neck and then the back and thigh joints; then the knee and ankle joints, and finally the arms and wrists, to such a degree as to leave him in an entirely helpless condition. Then followed a chronic diarrhoea, that necessitated the taking of large doses of opium to retain any nutriment. His complexion was sallow, his joints enlarged and painful, but with no appearance of superficial inflammation. This had all intervened from April to November, when treatment by static electricity was commenced and applied daily with light shocks, from the cervical region to the extremities—the patient being placed upon the insulating

table. After three months' treatment, varying the mode of application to and from the patient, the diarrhœa ceased and the appetite increased; but an intolerable irascibility ensued, with apparent congestion about the head. Venesection was resorted to, and much relief and comfort afforded the patient. It was then observed that he could again use his hands and had some power to move the elbow and shoulder joints. After ten days a similar condition of distress ensued, and relief again afforded by venesection of about sixteen ounces. After this he was able to push a chair before him and thus walk. The joints were much lessened in size and comparatively soft from that of almost cartilaginous hardness. From this time his physical condition gradually improved, and locomotion became more and more tolerable, so that in the following month of May he was able to mount a horse and ride, although his back and neck remained partially fixed. At this time electricity was applied twice a week until August, he being then quite active, and prepared to leave home for the South to spend the winter. He returned home the following spring and became president of the Housatonic Bank. This was in 1837 or '8, and ever since that time I have used static electricity as a therapeutic agent when possible to obtain it, which at that time could only be had in a dry atmosphere. Now, through the improved Holtz induction machine, static electricity can be obtained, in all probability, ten months in the year, and in such profuse quantity that it can be made available to the most satisfactory degree. And recent improvements made by Mr. Berge, of our city, may tend to better results.

In the *London Lancet* of June, 1846, a statement appears of Dr. Golding Bird's experience in the use of static electricity in Guy's Hospital, London, which agrees most closely with my own. Dr. Bird, from his large experience, classifies the following forms of paralysis that are relieved by the judicious application of static electricity.

The favorable results, as stated by Dr. Bird, of cases carefully noted, and his highly appreciated professional standing, places his statements beyond controversy, and induces me to present them again to the medical profession as an evidence of my own experience from the long continued use of static electricity.

- 1st. Partial paralysis from organic congestion, or effusion, which has been removed.
- 2d. Paralysis of the *portea dura*, of the seventh pair, from exposure to cold.
- 3d. Paralysis of a limb from the same cause.
- 4th. Paralysis of one side of the body or a

single limb, from exhaustion—as from lactation and flooding.
5th. Paraplegia from rheumatism, paraplegia from enervation.

He found the use of electricity most successful in recent cases, and contends against its use in many of the established organic lesions: stating that he has known fatal apoplexy to follow its application in cases of ramollissement of the brain, or where indurated arteries existed. I would here state that venesection is essential in the treatment of these cases with static electricity, and dangerous if omitted.

And, moreover, he remarks that he has never known electricity to do any good in rigid flexion of the thumb or fingers.

Under various modes of electrical application we find, however, that paralytic contraction has been successfully controlled in cases of diminished tone in certain sets of muscles impaired by long continued extension, that impairment of the balancing muscular force having even tended to contortion.

Dr Bird remarks: "From the want of exercise, the muscles of the affected limb become atrophied. The power of electricity in this respect is very remarkable, frequently restoring power to the paralyzed muscles in a very short time."

Dr Todd, in a paper in the *Medico-Chirurgical Transactions* of 1847, from a large number of observations, arrives at the following conclusions: 1st. That irritability of paralyzed muscles is in direct relation to their state of nutrition. 2d. It varies with the condition of nerves, more than with that of the muscles themselves. 3d. In a majority of cases of cerebral palsy, the contractility of the paralyzed muscles is less than that of the muscles of the sound side, on account of diminished nutrition. 4th. No diagnostic mark to distinguish cerebral from spinal paralysis can be based on any difference in the irritability of the muscles. 5th. The irritability of paralyzed muscles under the influence of galvanism is an index to the state of their nerves. This applies equally to static electricity. These are indications to be carefully considered in the use of electricity as a therapeutic agent.

In regard to the efficiency of static electricity, Dr. Golding Bird expresses his favorable opinion of its use in the treatment of nervous diseases, of which I will give a synopsis. His mode of applying electricity is by insulating the patient. In regard to the drawing off of electricity, silently in connection with the earth, he remarks: "During the discharge, heat is

evolved, the circulation becomes quickened, the secretions generally become more active, and perspiration breaks out. A person thus situated is said to be in an *electrical bath*; and it is by no means improbable that this might be frequently employed with advantage in certain affections in which the functions of the skin and nervous membranes are deficient."

Dr. Bird presents a common mode of applying the static electricity by insulating the patient and drawing off sparks, which method is subject to much modification by drawing heavy or light sparks, and from various parts of the body and limbs, but more especially from the spinal column.

Paralysis of the extensors of the hands from lead poison, known as *dropped hands*, are mentioned by Dr. Bird in his reports, in which he refers to eleven of these cases treated by static electricity. Five, he says, were cured, three relieved, and one improved; two received no benefit whatever. Sparks were generally drawn in these cases from the upper part of the spine while the patient was seated on the insulating stool, in order to influence the axillary plexus. Four of these cases are most worthy of note:

1st. A compositor, aged nineteen. Paralysis of the extensors of both hands, with amaurosis, preceded by an attack of lead colic. After four months of interrupted treatment the paralysis was cured, but the amaurosis remained, though the pupils, previously nearly insensible, contracted and dilated readily.

I have treated many cases of these ailments, arising from lead poisoning, successfully, with static electricity alone. In obstinate cases I have given the patients, in divided doses, twenty grains daily of *antim. sulph. aur.*, or the hydro-sulphuret of antimony, which we believe, from the relief afforded patients thus affected, to be of great benefit. In fact, patients were perfectly cured by this medicine, and without the assistance of electricity, but not in so brief a period as when electricity was made a part of the treatment.

As we have before stated, dropped hands are often the result of long continued position of the hands in a state of tension, as occurs in some occupations when closely applied to labor; shoemakers, clerks, and persons engaged on fine needle-work, or any similar employment requiring the fingers to be fixed and long retained in a state of tension. Of this class of patients, nearly every one is perfectly curable with static electricity, and often after dynamic electricity has failed.

In the treatment of this variety of partial paralysis of the fore-arm and hand, we but seldom insulate the patient, and simply pass light shocks from the elbow to the extremities of the fingers, having an elastic spring support applied, to keep the hand extended by such support. From this treatment of patients under fifty years of age laboring under this ailment, we know of no failures to improve the condition of the arm and hand, although a great number present for treatment, every year, at the Hospital for the Relief of the Ruptured and Crippled. Ordinary splints to keep the hand extended serve a tolerable purpose, and should be made available where elastic support cannot be obtained.

Dr. Bird speaks of the most remarkable influence from static electricity in rheumatic paralysis before the wasting of the muscles. Out of ten of these cases, only two failed to be relieved and cured. This, by far, exceeds any other treatment in its curative tendency.

Twelve cases of paralysis from various causes treated by Dr. Bird in Guy's Hospital resulted as follows :

1st. A man, aged thirty, with hemiplegia of right side, of nine months' standing, induced by a fall in which he struck his head ; cured in four months.

2d. A woman, aged fifty-two, with partial paralysis of motion and of feeling of right arm ; cured in five months.

3d. A waiter, aged forty-six, with paralysis of motion of right half of the body, with some loss of sensation, of three months' standing ; cured in three months.

4th. A smith, aged twenty-two, with recent complete paralysis of motion of right arm ; cured in one month.

5th. A boy, eleven years old, with complete paralysis of motion on the right side, of seven weeks' standing. Sparks were drawn from spine and limbs. After first application, walked back into the ward with the aid of a stick. In a few days completely cured.

6th. A coal porter, with paralysis of right arm and face. November 29th : sparks from spine, face and arm. Cured in one month. These cases, with others, are more fully stated in my book on orthopædia, p. 131.

We have treated many similar cases with static electricity, differing somewhat in the application, but with quite equal success. Dr. Bird's experience fully confirms my own, which is of many

years' practice in the use of electricity in its various modifications; and we have been most favorably impressed with static electricity as a curative means, though requiring great care in its application. We have seen patients irrecoverably injured by injudicious treatment with both static and dynamic electricity. Matteucci has pointed out the entire exhaustion of nervous power, similar to paralysis, resulting from an excessive use of electricity. If the improvement ceases under the use of electricity, I would recommend the discontinuance of the agent for a week or two. The progress in treatment by electricity is by this interim of rest rendered again susceptible to improvement, and more especially after a strengthening regimen, with tonics and friction, carefully guarding the patient from exposure to cold.

M. Bermond, of Bordeaux, relates a case of hemiplegia, following apoplexy, in a lady, aged twenty-six, in which the Leyden jar was successfully employed. After three months' medical treatment the hemiplegia remained nearly complete. The memory was slightly impaired, and there was unusual nervous irritability. At the first sitting, shocks from the jar were passed from the hand to the foot of the affected side. After fifty more moderate shocks considerable improvement manifested itself. After the fourth sitting, four days later, the patient took some steps. At the tenth sitting, seven weeks from the commencement, the patient walked to the office of Mr. Bermond. After the eleventh application, a week later, the cure might be considered as almost complete. The shocks were increased in number toward the close, and directed, at times, to a single limb, or to the tongue. This was a case of unusual discouragement.

This gentleman relates another case, even more discouraging as to affording relief to a lady, aged fifty-six, who, when in full health, was attacked with apoplexy, resulting in hemiplegia, and which remained after relief from the apoplectic seizure. Speech was difficult, the saliva constantly flowing from the corners of the mouth. Taste and hearing were both affected, deglutition difficult, the bladder distended, constipation at first obstinate, and cramps in the paralyzed limbs frequent for the first fifteen days. Edema at length appeared throughout the left side. After a month a slight improvement had taken place in other respects, when electricity was applied. After the first application the patient was able to stand, and even to stoop slightly and recover the erect position. On the following day, the features had be-

come more regular, the hearing improved, the œdema diminished, and an abundant perspiration had ensued upon the limbs of the left side. The application was then repeated. The circulation increased in force, and on the third application, which took place two days later, the pulse was greatly increased and plethoric symptoms induced, which yielded readily to treatment. After twenty applications, the patient had essentially recovered.*

I have related this case as a representative condition of a number of cases that we have treated, where the patients were of full habit and laboring under paralytic seizures. The electric treatment invariably increased the circulation of the blood to a plethoric condition, that in many instances hydragogue cathartics afforded no relief, but required for their relief venesection. This plethoric disposition is a most favorable indication of recovery, indicative of an obscure internal congestion relieved by the diffusive effect of electricity and developed in the superficial circulation. Such cases advance to recovery upon the reduction of their plethoric condition. In a majority of these cases, hydragogue cathartics are all-sufficient as derivatives that afford relief. Our treatment is the application of light shocks passed from the upper cervical vertebræ to the extremities of the limbs—the patient being insulated—and at the same time drawing off the electricity from the extremities with metallic points, carefully observing the influence upon the patient, as we have observed in some patients a decided indication of prostration whilst under the direct influence of the electricity. The veins become greatly dilated in the feet and hands, apparently lessening the circulation about the vital organs—an effect not producible by dynamic electricity, to the same extent. This equalization of the vascular circulation by diversion from congested tissues in *delicate patients* supersedes depletion, and thus avoids an expenditure of vital force, such as made in blood-letting, evacuants, and starving the patient.

* Bul. Med. de Bordeaux.



